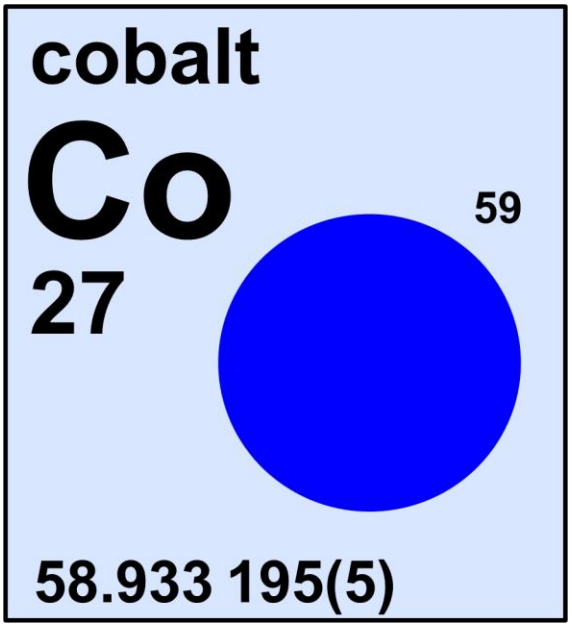
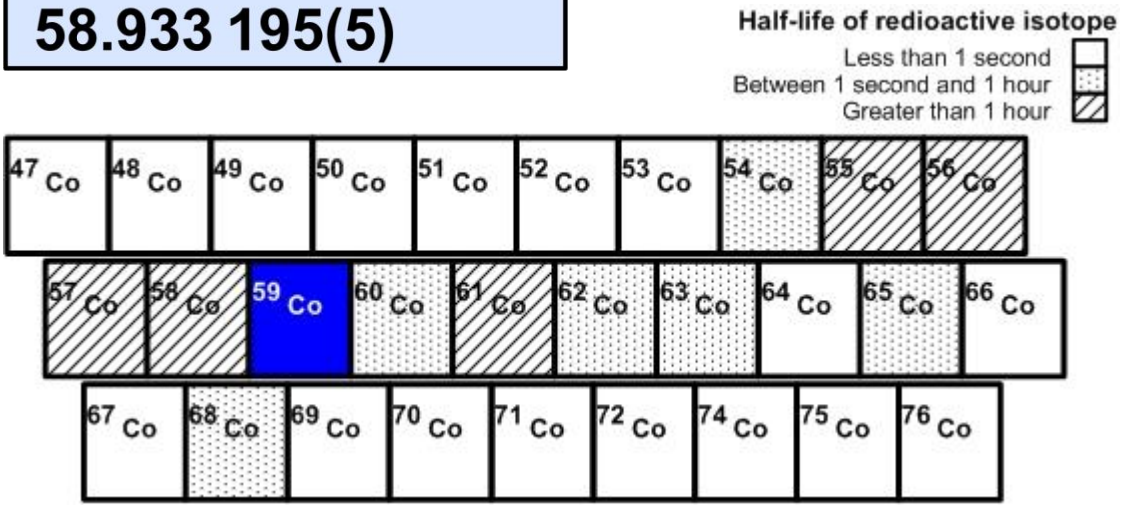
cobalt



Stable isotope	Atomic mass*	Mole fraction
^{59}Co	58.933 195	1.0000

* Atomic mass given in unified atomic mass units, u.



Important applications of stable and/or radioactive isotopes

Isotopes in medicine

1) ^{60}Co is a radioactive metal isotope that is used in radiotherapy-type cancer treatments. When ^{60}Co undergoes radioactive decay, high-energy gamma rays (energies of 1.17 MeV and 1.33 MeV) are emitted and can be used in brachytherapy to treat various types of cancer. Brachytherapy (brachy- is Greek meaning, "short distance") is a method of radiation treatment in which sealed sources are used to deliver a radiation dose at a distance of up to a few centimeters by surface, intracavitary, or interstitial application.
2) Radioactive ^{60}Co is used commonly to treat cancer. The ^{60}Co is used as a source of high-energy ionizing gamma radiation that can be directed to cancer cells from a device outside the body (external radiation therapy).
3) ^{60}Co (and sometimes ^{57}Co and ^{58}Co) is the key component of the Schilling test, which is a method for determining whether a patient's body is making and using vitamin B12

properly. The cobalt isotope is attached to vitamin B12 as a radiolabel to help monitor how the body processes the essential vitamin.

4) ^{57}Co is used for the study of anemia cases related to deficiency of vitamin B12.
5) ^{57}Co delivers the smallest radiation dose of all the cobalt isotopes, so it has been used in the past as part of a labeling technique for imaging and estimating organ size and location and also in evaluating tumors of the head and neck.
6) Many medical products today are sterilized using gamma rays from a ^{60}Co source. This technique of sterilization is generally much cheaper and more effective than steam heat sterilization because it is a cold process (for example, it can be performed on packaged items such as disposable syringes). It is therefore a more applicable sterilization technique to a wide range of heat-sensitive items such as powders, ointments, and solutions as well as biological preparations such as bone, nerve, skin, etc., used in tissue grafts.

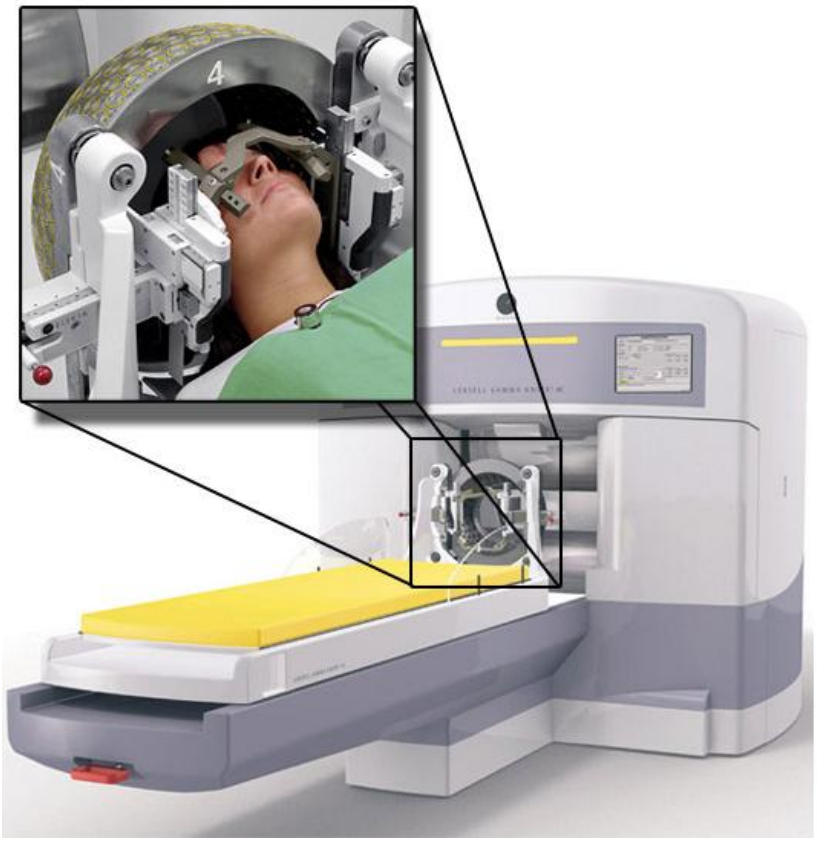


Figure 1: The Gamma Knife is a machine that uses gamma radiation from ^{60}Co to treat cancer.

Isotopes in food

1) ^{60}Co is used in food irradiation as a method of preserving food. The food is exposed to radiation from ^{60}Co, which kills bacteria and other organisms that cause disease and spoilage so that the food can have a longer shelf life. There is some controversy about the use of irradiation as a way of preserving food. For example, some individuals worry that

harmful compounds will be produced during the irradiation process. However, currently no proof has been found that irradiation is a dangerous method of food preservation.

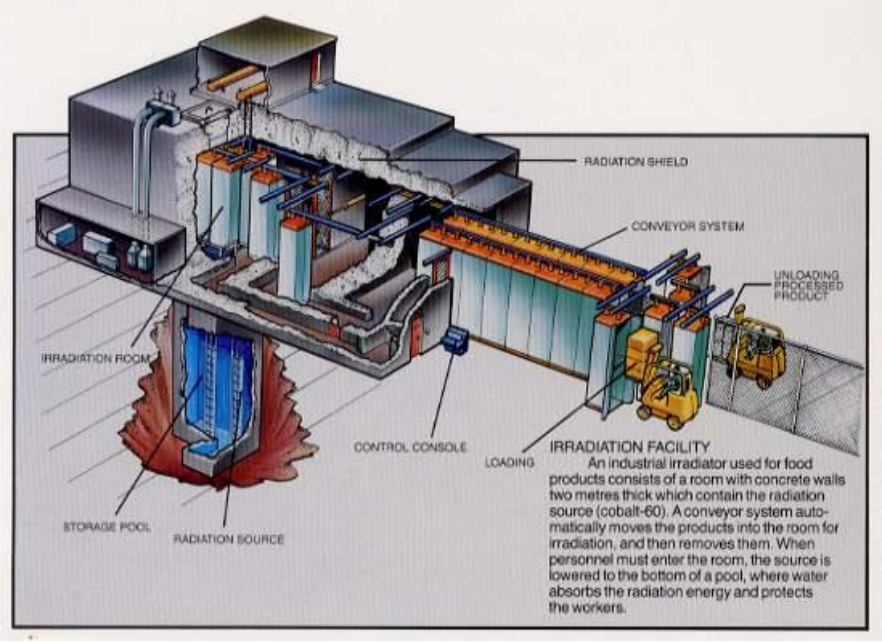


Figure 2: A depiction of a facility where ^{60}Co is used to irradiate food items.

Isotopes in industry

1) ^{60}Co is also used in industrial radiography to detect structural flaws in metal parts. The radiation can penetrate metals and the X-ray pattern produced by the radiating material can tell its strength, composition and other properties.
2) Because of the above property, ^{60}Co is also used in leveling devices and thickness gauges used to test welds and castings.

Figure 3: Device which uses ^{60}Co for the radiography of steel.